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THE GRINNELL ICE-CAP

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RESULTS OF THE RAWSON-MACMILLAN SUBARCTIC EXPEDITION OF 1927-28

The Grinnell Ice-cap has not yet been fully explored, and consequently its nature, behavior, and extent are only partially known. The purpose of this paper is to publish such data as could be found and make them available for those interested in glaciers and glacier explorations.

I have been particularly fortunate in having known the members of the various expeditions which have visited the ice-cap within the last few years. I have secured their field notes or have discussed the subject at length with them. My own visit to Frobisher Bay has also aided me in understanding certain features of the ice-cap.

I wish to express here my sincere appreciation to Captain J. T. Crowell, Jr., for permission to use his field notes and for critically going over them with me; to Mr. Ralph E. Brooks for the photographs (figs. 2, 3, 6, 7, and 8) and for helpful information; to Mr. Kennett Rawson for assistance rendered in the field; and, finally, to Captain Donald B. MacMillan for many considerations shown me during the expedition.

The Grinnell Ice-cap occupies the summit of the highland between Hudson Strait and Frobisher Bay, Baffin Land. Although Sir Martin Frobisher discovered Frobisher Bay in 1576 and led two more expeditions in the following summers into the same bay within sight of the ice-cap, there is no reference to it in any of the literature concerning his voyages. Apparently, he was not interested in glaciers, or he believed the ice-cap to be a snow-covered area—a feature common to arctic regions.

The first mention of the ice-cap appeared in 1865. In that year, Captain Charles Francis Hall, in his "Arctic Researches and Life among the Esquimaux," published the results of his explorations about Frobisher Bay, then known as Frobisher Strait, in the years

JUN 9 1937

1860–62, and described the ice-cap, which he named Grinnell Glacier after Henry Grinnell of New York. Captain Hall was an American navigator, who afterwards became Commander of the United States Polar Expedition ship, the *Polaris*.

Unfortunately, Hall's description is much too indefinite and is unsatisfactory from a geological point of view. He placed too great faith in the hearsay information of his Eskimo companions. As a result, many of his statements, derived from that source, can only be accepted as indirect evidence. Nevertheless, his description contains many useful data which may be of interest, particularly to those who may visit and study the ice-cap¹ at any future time.

Since Hall's Journal is not readily accessible and since his description of the ice-cap is widely scattered, I have deemed it advisable to quote here such portions as might be of interest and have immediate bearing on the present subject.

August 21, 1860 [p. 118].—The land on the opposite side of the "Straits"² was clear before me, though at a distance of some forty miles, and it appeared as if a long line of ice or snow topped a considerable portion of it. . . . But not till some months afterward, when exploring up the "Straits," did I have positive proof that what I now saw was really an enormous and magnificent glacier, which, when I visited it, I called after the name of Henry Grinnell.

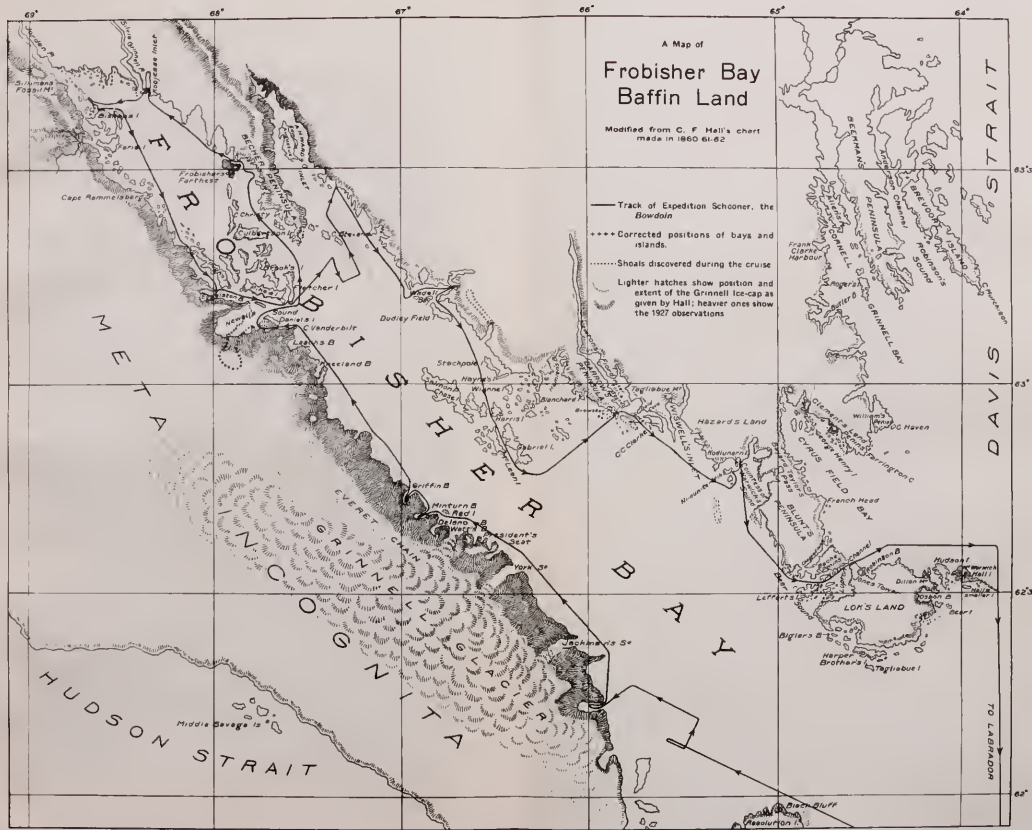
April 25, 1861 [pp. 262–263].—As we traveled forward [from near Nouyarn Island, Lat. 62° 55' N., Long. 65° 52' W.] the mountains of Kingaita [an Eskimo name, same as *Meta Incognita* of Sir Martin Frobisher] loomed up in magnificent grandeur. . . . It seemed as if a huge ice ridge ran along parallel with the coast, uniting mountain with mountain and peak with peak. Seeing how intent I was upon this, Kokerjabin [an Eskimo woman companion] readily answered my inquiry as to what it really was. In reply, she said that it was solid ice, and never had she known it to change its appearance, either in summer or fall.

May 1st, 1862 [pp. 516–521].—I started from this encampment [ninth encampment, Lat. 62° 51' N., Long. 66° 40' W., due east of Gabriel Island] on a trip to

¹Precautionary measures should be taken before a trip to the ice-cap is attempted. Frobisher Bay has never been officially charted. The only chart available is the one accompanying Hall's "Arctic Researches and Life among the Esquimaux." This is, however, an outline geographical map and, therefore, not of great value to navigators. Furthermore, the map contains many inaccuracies due to the fact that Hall made the greater part of his observations from a distance, and that, too, in the winter, when the snow covered both ice and land. The bay contains numerous shoals, low islands, and hidden jutting rocks, so that anyone not previously warned of the dangers is apt to have his boat on the rocks when his journey has scarcely begun. The tides in the bay, as observed in 1927, rise as high as forty-eight feet and when setting in different directions among islands create currents of great velocity and often give rise to dangerous whirlpools. The region is also notoriously stormy and for the most part obscured by fog. The Eskimos, who are thoroughly familiar with these conditions, are of inestimable service and should be procured as guides.

²Hall reached the headwaters of Frobisher Bay in the summer of 1861. Until then it was known as the "Straits"—an open arm of Davis Strait.





Kingaite coast. . . . We started, at 7:40 A.M., for the point [President's Seat, the most conspicuous mountain on the coast of Frobisher Bay, Lat. $62^{\circ} 39' N.$, Long. $66^{\circ} 40' W.$] I had selected . . . where an ascent could probably be made of the glacier which I had seen on my voyage up the bay the previous fall [spring].

My course across the bay to Kingaite coast was S. $4^{\circ} E.$, true. The number of dogs in the team was ten, but, as they were in poor condition, we made but three and a half to four and a half miles per hour. . . . A few minutes before noon we drew into a small bay that extended on toward the point I sought to reach. . . .

As the dogs turned up the narrow bay leading to the point of land we were making, I was delighted to see the face of an abutting glacier, which fully proved the truth of my anticipations that there were iceberg discharges on Kingaite side. At noon our progress was arrested by the glacier, which seemed to smile a defiance. . . . Here, by this crystal wall, I stood . . . beholding its beauty and grandeur . . . , after which we were prepared for an attempt to scale the ice-mountain. This could be done only by ascending one of the rock ridges flanking the abutting arm of the glacier, and thence striking up its steep side.

For the first quarter of a mile it was very abrupt, and difficult to climb. The most laborious and dangerous part of the ascent was accomplished by following the footsteps of a polar bear. . . . After first quarter of a mile the inclination of the glacier was gradual, then for a quarter of a mile farther it became greater, but it did not so continue. Each side of this arm of the glacier was walled in by mountains, the east side by the group I called the President's Seat.

On making two miles, S. $16^{\circ} E.$, true, we arrived where the glacier opens to a sea of ice. At this time and point the glacier was covered with snow, with a cropping out here and there of the clear crystal blue ice, giving relief to the view of an apparently illimitable sea of white around. My Innuít [Eskimo] companion, being well experienced in all the coast from Karmowong, a place on the north side of Hudson's Straits, to Resolution Island, and all about Frobisher Bay, said that this great glacier extended far, far below where we then were, and also continued on northwest a great way, reaching over [to southeast] also nearly to Hudson's Straits. From the information I had previously gained, and the data furnished me by my Innuít companion, I estimated the Grinnell Glacier to be fully 100 miles long. At various points on the north side of Frobisher Bay, between Bear Sound [Lat. $62^{\circ} 31' N.$, Long. $64^{\circ} 50' W.$, named by Frobisher in 1577 after James Bear, master of the *Michael*, one of the expedition ships of Frobisher] and the Countess of Warwick's Sound, I made observations by sextant, by which I determined that over fifty miles of the glacier recedes from the coast, and is lost to view by the Everett chain [Lat. $62^{\circ} 40' N.$, Long. $67^{\circ} W.$] of mountains; and as Sharkey [a male Eskimo companion] said, "the ou-u-e-too [ice that never melts] extends on wes-se-too-ad-too [far, very far off]." He added that there were places along the coast below what I called the President's Seat where this great glacier discharges itself into the sea, some of it large icebergs.

From the sea of ice down to the point where abutting glacier arrested my advance with sledge and dogs, the ice-river or arm of the glacier was quite uniform in its rounding up, presenting the appearance . . . though in a frozen state . . . of a mighty rushing torrent. The height of the discharging face of the glacier was 100 feet above the sea.

In 1897, thirty-five years after Hall's exploration of Frobisher Bay, Russell W. Porter, accompanied by a party of seven men,



FIG. 1. Grinnell Ice-cap as it appears behind coast of Frobisher Bay.



FIG. 2. Tongues of Grinnell Ice-cap reaching out to Frobisher Bay.

entered Frobisher Bay on August 11. He ascended the Grinnell Ice-cap on September 5 by way of a tongue-like outlet descending into Watt's Bay, Lat. $62^{\circ} 38' N$. This tongue was named Boas Glacier by Porter after the distinguished anthropologist, Dr. Franz Boas, of Columbia University. Porter's brief description of the ice-cap is as follows:

Thursday evening, Sept. 4th, the boats entered Watt's Bay (14th encampment), and the tents were pitched on its northern shore. . . . Across the bay, two miles to the southwest, was the blue wall of a glacier (Boas Glacier), hemmed in on either side by high mountains. On the horizon, back of it, a luminous glare from the ice-cap lit up the fog and mist which was shutting down over the landscape.

The next day, although fog and occasional rain made climbing disagreeable, we ascended the glacier. One mile to the right of its face a beautiful waterfall emptied into the bay. From an elevation of 300 feet above high water this glacial stream slid over the smooth rock in a convex elliptical curve, which at the water's edge was nearly vertical.

The face of the Boas Glacier is approximately 150 feet high and has a frontage of some 100 yards. The glacier was not discharging to any noticeable extent, there being no bergs in Watt's Bay.

In the center of the ice stream, and perhaps half a mile from its face, the writer set up a signal pole of bamboo, marking the spot additionally with a pile of rocks. Then cairns were erected on the shore in line with the pole, and sketches of the surrounding locality made for the purpose of identifying the spot in winter.¹

The Boas Glacier is an easy one to travel on. It has an angle of descent of 15° with the horizon, and on its southern side one can walk directly to the ice-cap above. It can be crossed at almost any point. Its surface is clean and hard, carrying but little detritus, and in September was melting and furrowed by many streams of water. The so-called "pot holes," found in numbers on the Greenland glaciers, were conspicuous by their almost total absence.

At a distance of two miles from the face of the glacier the consistency of its ice changes to that of snow, and half a mile farther on, the ice has entirely disappeared as well as the crevasses. The horizon to the west was obscured by fog, but the appearance of the ice-cap at this place was that of rolling plains of snow through which a single nunatak forced itself.

The writer, accompanied by Mr. Shaw, reached this "island of white sea" after floundering through wet snow knee-deep, and succeeded in reaching its summit, where a cairn was built and a record deposited. It had an elevation above the bay (by aneroid) of 2,380 feet.

In the summer of 1927, while a member of the Rawson-MacMillan Subarctic Expedition to Labrador and Baffin Land, I made several attempts to study the nature and extent of the Grinnell Ice-cap but I was handicapped by foggy weather and other menaces to navigation. The difficulties encountered and the limited results

¹ Porter intended to revisit the glacier the next summer (1898) to ascertain its rate of flow, but this he was unable to do.



FIG. 3. Small icebergs formed by calving of a tongue of Grinnell Ice-cap.

achieved may be gathered from the following account, summarized from my field notes:

We crossed Hudson Strait, passed around the east side of Resolution Island, and headed westward, entering Frobisher Bay on the evening of August 9. An impenetrable fog and a turbulent sea prevented us from hugging the coast and we did not see the south-eastern extent of the ice-cap.

Our first anchorage was in an unnamed bay (Lat. $62^{\circ} 13' N.$, Long. $66^{\circ} W.$), about nine miles southeast of Jackman's Sound. Here we anchored two days, during which time I made four attempts to see the ice-cap, going far inland and ascending 1,830 feet (aneroid), but the fog never once lifted and it was impossible to see anything beyond a few feet. On the morning of August 12 the weather cleared a little, but as our working days were numbered and much reconnoitering was ahead of us, we heaved anchor and sailed northwestward, keeping as close to the shore as safety would permit. Within an hour (we were running about 8 nautical miles an hour), for the first time we saw the glistening white surface of the ice-cap and several tongues (fig. 2) at intervals of one-half to two miles flowing in the valleys of the high, rocky coast of the bay. None of these tongues, however, seemed high or thick. Apparently, there was occasional calving, as evidenced by small icebergs (fig. 3) near-by or at the head of some of the inlets. We tried to make shore, hoping that it might be possible to reach the ice-cap by way of one of the tongues, but the sea was still very heavy. High waves dashed against the bold cliff; we could not land. We continued our journey and hoped that the sea would moderate, but before long we lost sight of the ice-cap. At dusk we entered Griffin Bay, a deep fiord, evidently the result of glacial excavation and coastal sinking. So deep was the fiord that we could not find anchorage with a hundred-fathom chain within fifty feet from the shore. Finally we moored with quarter lines to a cliff.

On the following morning (August 14), Kennett Rawson and I worked our way inland for a distance of four miles. In the course of our walk, we saw evidences of former glaciation—dammed-in lakes (fig. 4), ground moraines, massive striated boulders, well-developed cirques (fig. 5), U-shaped valleys, arêtes, horns, and practically every major sculpture one might expect to find in a region which once supported large valley glaciers. By now, it was evident to us that the longitudinal direction of the ice-cap was not wholly parallel to the coast as we had believed it to be when on our way to Griffin Bay,



FIG. 4. A glacial lake near the head of Griffin Bay.

but must be at an angle. To check our inference, we ascended a high hill (2,420 feet, aneroid) to our right. As we reached the summit facing southeast, the ice-cap appeared in the distance like a white Sahara, lying, as we had expected, in southeast-northwest direction. The southeast border was near and more or less parallel to the coast; the northwest border was many miles farther inland. The advance of the ice-cap on the southeast side seemed checked by the bold walls of an incredibly barren coast except at a few flanks through which it was finding its sinuous way to the sea. We could not estimate the distance between us and the ice-cap but it could not have been less than four miles on the southeast side, perhaps more. We had no way of judging the distance to the northwest side. Snow-capped hills rose above hills, beyond which lay a white ridge of which we had but a few glimpses through the rifts in the fog.

According to Hall's chart, the ice-cap was not only supposed to exist where we were but also to extend at least seventeen miles northeast of us. So far as we could see, it does extend northward but its extent is to the northwest, not northeast. Hall, as stated before (footnote 1, p. 2), made his observations during winter when snow covered both ice and land, and this might well have been the source of his error.

In 1929 Captain Donald B. MacMillan, Ralph E. Brooks, Kenneth Rawson, and Frank Henderson ascended the ice-cap from a tongue reaching out to York Sound. Unfortunately, no notes were taken of the trip, and the details of their exploration are, therefore, not available. I was, however, informed verbally by Mr. Brooks that he had traveled a considerable distance in various directions over the ice-cap and that both he and Captain MacMillan had independently observed that it was not continuous but was divided by a non-glaciated area some distance south of York Sound. They also erected a pole on the ice front by which to check the rate of the advance of the ice-cap, but two years later when Mr. Brooks again visited the place he was unable to locate the mark.

In August, 1931, Captain J. T. Crowell, Jr., and Mr. Brooks, the radio operator of the *Bowdoin*, ascended the Grinnell Ice-cap and traveled the greater part of a day over it. The record of their travel is the most illuminating of any information as yet known of this ice-cap. It gives an excellent picture of the conditions one would meet when setting out to explore the ice-cap. With Captain Crowell's permission, I am quoting here the following extracts from his log book:



FIG. 5. A well-developed cirque. Northwest coast of Frobisher Bay.

Schr. Bowdoin, Frobisher Bay: August 5, 1931.—We entered York Sound, Lat. $62^{\circ} 34' N.$, Long. $66^{\circ} 35' W.$, on the afternoon of August 5, 1931, and hoped for clear weather so that we could photograph the glacier. One tongue of it enters this sound and slopes off gradually so as to afford access to the surface of the glacier. We could not take pictures of the ice because of the fog but Ralph Brooks [the radio operator] and I decided to ascend without waiting for the weather to clear. Ralph was on this very ice tongue two years ago with MacMillan, Frank Henderson, and Kennett Rawson, when the *Bowdoin* was in here before.

At about nine in the morning we got on the glacier [fig. 6] on the southeast corner and working to the right to avoid crevasses as much as possible where the glacier turns to the southeast we worked up. When we were on top of the first big rise, the fog began to shut in thicker and only at intervals could we see the very high land on each side. Shortly after going around the bend which shuts out the view of the bay we encountered crevasses, but we worked to the left again and were soon clear of the worst of them. Brooks said that the surface of the glacier was much more easily traversed than it had been two years ago. That was about August 22 and most of the snow had gone from the top of the ice, making it very glaring and slippery; also there was much more water running on the top than now. The glacier turns again to the southward and becomes steeper. Here we stopped and lashed the crampons on our feet. Proceeding, we caught glimpses of tremendous ice-falls on the left coming down over a sheer cliff that must be a thousand feet above the surface of the glacier. After passing this we encountered more snow and we wandered in the fog, always ascending until we could see the high land on the right side of the ice. Here also were ice-falls but much less in magnitude than the others, seen on the left.

The snow was now deeper and the slope more steep; we were forced to zigzag to find ice bridges on which to cross the crevasses. Looking down over the edge we could see no bottom, and chunks of ice thrown in would rattle on down, the sound growing fainter and fainter. We could not hear them striking bottom. The crevasses varied in width from a few inches to several hundred yards.

After lunch we proceeded on our way up. There was not much water on this part of the glacier, probably because it drained off into the many crevasses and did not accumulate into streams as it did on other parts of the ice. We now judged it to be about noon, and we began to get into better going and among fewer crevasses. Fog was still with us and we kept expressing the hope that it would clear so that Brooks could get pictures and we could get the lay of the land. Gradually we got into smoother ice. We could hear a stream of water running on our left and ahead, and we made our way towards the sound. The ice now became quite a bit steeper and, as we proceeded, steeper still. We found the stream which was running very rapidly in a bed about a foot deep and about four feet across, which it had worn in the ice. There were no crevasses in this area. The ice had a very steep slope now and we surmised that we must be above some ice-falls similar to those seen from the lower glacier. We began to fear that we might get too close to the edge in the fog and be in danger of slipping off, as the ice was smoother and covered with running water; so we began to work eastward at right angles to the slope. Soon we saw land on our left and below us slightly. We made for this and climbed out on it. While Ralph was wringing some of the ice water out of his socks I worked over to the other edge of the rock and peered down through the fog. There on my left was the ice-fall [fig. 7] which passes on the west or southwest side of this nunatak.



FIG. 6. York Sound Glacier. A tongue of Grinnell Ice-cap.

Tremendous masses of ice, like icebergs, were hanging to the side of that sheer cliff, which extended down beyond my vision. I could not see the glacier. We had no barometer with us and could not judge the height, but must be very high, as I felt very dizzy and slightly nauseated. Another ice-fall extended down on the other side of our nunatak and also disappeared abruptly over the cliff and was lost in the fog.

Here we wrote our record, signed it, enclosed it in the National Geographic Society brass cylinder and placed it in a rock cairn on a high place in the rock [fig. 8]. We also built two smaller cairns about ten feet from the edge of the ice (on the rock) and mentioned them in our record, so that later investigators might get some idea as to whether or not the ice is diminishing or increasing at this point.

After a rest of a few minutes we lashed on our crampons again and began our return, as the fog was getting thicker and it began to look like bad weather. We set out on the steep slope, being careful to keep away from the edge of the ice-falls and headed for where we thought we would pick up the largest of the water streams which we had seen. We found this and followed it down until we picked up our footprints. These we followed carefully so as to keep clear of the treacherous snow bridges over the crevasses, knowing that we were fairly safe in retracing our upward course. At times we lost the trail owing to bad light and the faintness of the crampon marks on hard ice, but we did not proceed until we picked them up again. We did leave the trail to look at and photograph some very wide and deep crevasses which must be near the ice-falls, although we could not see because of fog. But we followed the tracks down across the bad crevasses and into a region where there was deeper snow. This did not look good to us on the way up as we thought some of it covered crevasses. We were right. I was walking along, with Ralph about twenty-five feet in the rear (we were made fast to each other with about thirty feet of twelve thread manila), when my right foot broke through the crust and I fell forward. Sparks held taut on the line and braced himself, but the snow held the weight of my body, and I crawled out on to firmer footing. I had time, however, to look down that hole where my foot had broken through. As far down as I could see there was nothing but blue space. A few minutes later Ralph broke through with one foot, but he quickly stepped backward.

We continued to descend and in a half hour or so a break in the fog gave us a glimpse of the lower part of the ice-falls. We now realized that we had proceeded too far to the southeast side of the glacier. We were in another crevassed area with much running water. Many of the streams rushed along in deep-worn ice beds and suddenly plunged out of sight down a seemingly bottomless crevasse. The hollow rumble of their descent came back to us. We retraced our steps for a way and found better going for a while, but at last were forced to work out to the right to the very edge of the glacier and work along amongst the rocks and debris of the edge of the lateral moraine. Even in there amongst the rocks there were deep crevasses, as the rocks are only a superficial layer on top of very thick ice.

Gradually, we worked out onto better going and as we turned around the bend we could see the vessel far down in the bay. It looked very small compared to the ice and the huge cliffs. As we got down toward the shore edge of the ice tongue we saw some one coming for us in the gig and soon after we met Simeon on the shore, climbed into the boat and were soon aboard. It was about 5 P.M.

Friday, August 7, 1931.—The weather was still foggy so that no good pictures could be taken of the glacier. Brooks and I climbed the old *glacial trough*, which is



FIG. 7. An ice-fall. Grinnell Ice-cap flowing over a cliff.

on this bay [York Sound] but south of the glacier. There is a steep glacial tongue coming part way down this old trough. We climbed about seven hundred feet and came upon a small lake, as we had expected—a very deep basin with sheer walls rising high. The water from the ice tongue, which is far above but in sight, plunges down the bare rock for several hundred feet into this beautiful body of water. Last year's ice had not wholly melted away yet so that pans of clear white ice were floating on its glossy surface, and the snow banks still adhering to the cliffs were reflected in the lake. It is of course too high to be seen from the ship in the bay. We named this body of water Lake Alice, after Mrs. Crowell. We collected fossil-bearing¹ stones here and I made a collection of other rocks on the mountain. There are many varieties of lichens and mosses near the lake and on the way up we saw two arctic poppies; also other flowers and the purple flower which we see so often now but whose name I do not know. Many signs of lemmings at one mossy place.

SUMMARY

The Grinnell Glacier occupies the summit of the highland between Hudson Strait and Frobisher Bay, Baffin Land. It belongs to the ice-cap class, having characteristics intermediate between those of mountain and continental glaciers. Its southern portion lies more or less parallel to the west coast of Frobisher Bay, which, except for a few cuts and valleys, forms an effective barrier and prevents the advancing ice from descending into the sea. The longitudinal (southeast-northwest) dimension of the ice-cap is about eighty miles. Probably the ice-cap is not continuous² but is separated by a non-glaciated area some distance south of Lat. 62° 30' N. The extent of the ice-cap inland into the interior is not known, nor is its thickness known. Along the front borders of its southeast portion, it sends out several tongue-like outlets which, following a sinuous course, reach out to sea. Calving is taking place at long intervals but the resulting icebergs are of small size. Large icebergs (fig. 9) that are seen in and about Frobisher Bay have evidently had their origin in the Greenland ice-sheet.

The presence of many crevasses, which range from a few inches to several hundred yards in width, indicates that the rock pedestal supporting the ice-cap has numerous inequalities. So far as has been observed, only a single peak projects above the ice-cap. This nunatak can be more easily reached from a tongue descending into Watt's Bay than from elsewhere.

It is doubtful if the ice-cap ever extended much farther to the northeast than its present limit, for although the northeastern area

¹ I have not seen these fossils but I believe they are of Ordovician age, brought down by the glacier from Silliman's Fossil Mount at the head of Frobisher Bay.

² As observed by Mr. Brooks and communicated verbally to me. Mr. Brooks' observation has been substantiated by Captain MacMillan.



FIG. 8. A rock cairn containing record of travel of Captain J. T. Crowell, Jr. (standing) and Ralph E. Brooks.



FIG. 9. Icebergs in the vicinity of Frobisher Bay. These were discharged by the Greenland ice-sheet and drifted southward.

was glaciated it has none of the smooth and rounded features characteristic of a terrain overtopped by an ice-sheet. On the contrary, the landscape is extremely rugged, consisting of well-formed cirques, U-shaped valleys, serrated ridges, etc., all of which indicate that the region supported numerous independent mountain glaciers rather than an ice-sheet. The disappearance of these mountain glaciers and the existence of an ice-cap near-by may be due to decrease in atmospheric moisture in the northeast area and to its lower altitude. The Grinnell Ice-cap for the most part is surrounded on three sides by large bodies of water, namely, Hudson Strait, Davis Strait, and Frobisher Bay, and thus receives a much more plentiful supply of moisture than the northeast area, which has only the water of Frobisher Bay as its immediate source of nourishment. Furthermore, the Grinnell Ice-cap is of sufficient size to develop a local descending and centrifugally directed surface air current for at least part of the year.

The best time of the year to travel over the ice-cap is late spring, before the snows have begun softening or melting. The winter snows are then well impacted and all the dangerous crevasses and water holes are filled. Normally, however, it would be impossible to enter Frobisher Bay at that time, for the sea is seldom, if ever, clear of ice before the middle of July. The alternative is to winter there, which seems to be the only way by which one can take advantage of the best time of the year to explore the ice-cap.

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